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Impact Analysis of Incentive Scheme for Dump Truck Driver to Reduce Overspeeding at Oil and Gas Company

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Abstract. The phenomenon of overspeeding in transportation equipment is commonly encountered in daily life. This also frequently occurs in industries involving long-distance travel using transportation or heavy equipment, such as in the mining industry, where dump trucks are widely used. This study focuses on a case in the oil and gas industry. The research adopts a quantitative approach using linear regression analysis to identify the relationship between average daily incentives and the percentage of overspeeding, chi-square test to examine the association between types of incentive schemes and overspeeding categories, and t-test to compare the average incentives between drivers who commit overspeeding violations and those who do not. The data were obtained from the Integrated Journey Management System (IJMS), covering 1,087 dump trucks over a six-month period. The results indicate a positive relationship between incentive amounts and overspeeding levels. Incentive schemes based on trip productivity tend to increase the risk of speed violations compared to distance-based schemes. These findings have important implications for companies and contractors in designing incentive policies that not only consider productivity but also driver safety. Integrating safety indicators into the incentive structure is key to building a safe and sustainable internal transportation system in the oil and gas industry.
Keywords: driver incentives, dump truck, overspeeding, work safety, linear regression, chi-square

INTRODUCTION

The oil and gas industry requires high levels of operational logistics to sustain its production targets, particularly during the development of drilling locations. One such critical activity is site preparation, which involves extensive material transportation using heavy equipment—primarily dump trucks (Melati, 2017). In the case study company located in Sumatra, approximately 1,000 dump trucks operate daily to support this activity. While the volume and intensity of operations ensure productivity, they also raise significant safety concerns, particularly related to speeding behavior (Chaparro, Galilea, Muñoz, & Poblete, 2020).

Overspeeding, or the act of exceeding recommended speed limits, has been consistently observed despite the implementation of GPS-based safety monitoring systems such as the *Integrated Journey Management System* (IJMS). Data from November 2024 to April 2025 indicate recurring incidents of overspeeding among dump truck drivers, highlighting an urgent need to evaluate the underlying behavioral causes. Among the suspected contributing factors is the incentive system applied by partner contractors (Kusuma, Maulina, & Hutami, 2019).

These contractors often adopt two primary incentive schemes: one based on the distance traveled (per-kilometer, referred to as Scheme A) and another based on trip frequency or load counts (*ritase*-based, referred to as Scheme B). While intended to enhance productivity, these compensation structures may unintentionally motivate unsafe driving behavior, such as overspeeding, in pursuit of higher earnings (Kusuma, Maulina, & Hutami, 2019). This study aims to analyze the relationship between driver incentive schemes and overspeeding behavior using a quantitative approach (Birana, Alim, & Azwar, 2019).

Using empirical data collected from 1,087 dump trucks over six months, this research provides evidence-based insights to inform the design of safer, more balanced driver incentive models. The ultimate goal is to promote a culture of safety without sacrificing operational efficiency, especially in the high-risk environment of oil and gas logistics (Azizah, 2016; Belzer, 2012; Maschler, Solan, & Zamir, 2013; Rana & Singhal, 2015; Rahayu, 2022: Rifki & Marzuki, 2022).

Incentive structures have long been recognized as a driving factor behind employee performance and behavior, including in the transportation sector (Setiawan, Fauzan, & Norfai, 2020). Various studies have demonstrated that while performance-based incentives can increase productivity, they may also contribute to riskier operational decisions such as overspeeding, especially when incentives are tied to output volume or time pressure (Sonmax, Nina, Marwanto, & Anwar, 2022).

Hsu et al. (2024) studied time-sensitive incentives among food-delivery motorcyclists in Taiwan, finding that compensation tied to delivery speed and frequency significantly increased risky driving behavior, including overspeeding. Similarly, Belzer (2012) analyzed how economic incentives affect safety outcomes in commercial motor vehicle operations, highlighting the trade-off between productivity and safety. Chaparro et al. (2020) explored an incentive scheme designed to improve service quality among public bus drivers in Chile, demonstrating that incentives can influence both performance and adherence to safety protocols. These studies suggest that while incentives are effective in promoting desired outputs, they can unintentionally encourage unsafe practices when safety is not part of the incentive metric (Hsu, Lee, & Wong, 2024).

Overspeeding is recognized as one of the leading causes of traffic-related incidents in both public and industrial transport settings. Aarts and van Schagen (2006) reviewed the correlation between driving speed and accident risks, emphasizing that even moderate overspeeding significantly increases the likelihood and severity of crashes. In high-risk industrial environments such as mining or oil and gas logistics, the consequences of overspeeding can be even more severe due to the size and load of heavy vehicles like dump trucks (Syahreza et al., 2024).

The implementation of monitoring technologies such as the *Integrated Journey Management System* (IJMS) plays a critical role in observing driver behavior. IJMS records vehicle speed, routes, and stop durations, enabling the identification of repeated overspeeding incidents (Simatupang, 2021). However, the system only tracks behavior—it does not actively influence driver motivation, which is largely shaped by economic incentives and contractor policy.

Previous studies have demonstrated that incentive schemes significantly influence employee behavior, often creating a trade-off between productivity and safety (Sinaga, Sumarno, & Sari, 2022). Hsu et al. (2024) found that food delivery drivers in Taiwan exposed to time- and frequency-based incentives exhibited increased risky behaviors, including overspeeding, highlighting that performance-oriented compensation can unintentionally compromise safety. Similarly, Belzer (2012) observed that commercial motor vehicle drivers under output-driven pay schemes faced heightened accident risks, emphasizing the need to balance operational goals with safety considerations (Qumairoh, 2023). Although these studies provide valuable insights into incentive-driven risk behaviors, they primarily focus on light

vehicles or public transport settings, leaving a notable gap in understanding such dynamics in the oil and gas sector, where heavy vehicles such as dump trucks pose higher operational hazards due to their mass and load (Gravetter & Wallnau, 2016). Furthermore, while monitoring systems like the *Integrated Journey Management System* (IJMS) can track overspeeding incidents, they do not address the motivational drivers behind unsafe behavior.

While prior studies have examined the relationship between incentives and safety in public transport or ride-sharing, limited literature addresses this issue in the oil and gas sector—especially in operations involving third-party heavy equipment contractors. This study fills that gap by quantitatively analyzing overspeeding patterns in relation to driver compensation structures in a major oil and gas field operation in Sumatra, Indonesia. The research aims to provide empirically grounded recommendations for designing incentive structures that enhance productivity while maintaining a culture of safety, ultimately benefiting operational efficiency and minimizing accident risks in high-stakes industrial logistics.

RESEARCH METHOD

This study adopted a quantitative research approach to evaluate the effect of driver incentive schemes on the frequency of overspeeding violations among dump truck drivers in an oil and gas company. Descriptive and inferential statistical analyses were applied to assess correlations and group differences, aiming to inform incentive policy design that balances productivity and safety.

Data were obtained from the Integrated Journey Management System (IJMS) over six months (November 2024 to April 2025), covering operations of 1,087 dump trucks. Collected data included daily operational logs and speed records, overspeeding events with timestamps and severity, average daily incentives based on contractor schemes, and classification of incentive types (Scheme A: distance-based, Scheme B: trip-based). Incentive data were sourced from partner contractors and standardized to Indonesian Rupiah (IDR), averaged per driver per day for analysis (Mahajan, Velaga, Kumar, Choudhary, & Choudhary, 2018).

The dependent variable in the study was the overspeeding percentage, calculated as the number of overspeeding incidents per driver divided by total driving events during the period. The independent variables included average daily incentive (a continuous variable) and incentive scheme type (Scheme A or B).

Several analytical procedures were employed to assess the data. Linear regression analysis tested the relationship between average daily incentives and overspeeding percentage to determine whether higher incentives correlated with increased overspeeding. The Chi-Square test of independence evaluated the association between incentive scheme type and overspeeding severity categories (none, low, medium, high) to assess differences across schemes. An independent samples t-test compared average daily incentives between drivers who committed overspeeding violations and those who did not, identifying links between overspeeding behavior and incentive payouts.

Data processing and analysis were conducted using Microsoft Excel and SPSS. The data were cleaned, coded, and tested for normality and homogeneity before applying inferential statistical tests. Overspeeding events were grouped by truck ID and matched with incentive data according to the contractor scheme classification.

RESULTS AND DISCUSSION

During the six-month observation period (November 2024 – April 2025), data from 1,087 dump trucks were collected using the Integrated Journey Management System (IJMS). A total of 60 overspeeding incidents were recorded, involving 54 different vehicles. Overspeeding was categorized into four groups: non-overspeeding, low (1–10 km/h above limit), medium (11–20 km/h), and high (21–30 km/h).

Linear Regression

A linear regression was conducted to determine the correlation between average daily incentive (X) and overspeeding percentage (Y). The resulting model:

$$Y = 0.0000000011X - 0.0000680743$$

From the regression line, it was found that:

At an average daily incentive of IDR 61,885, the predicted overspeeding rate reaches 0%. The regression confirmed a positive correlation: higher incentives were associated with increased overspeeding behavior.

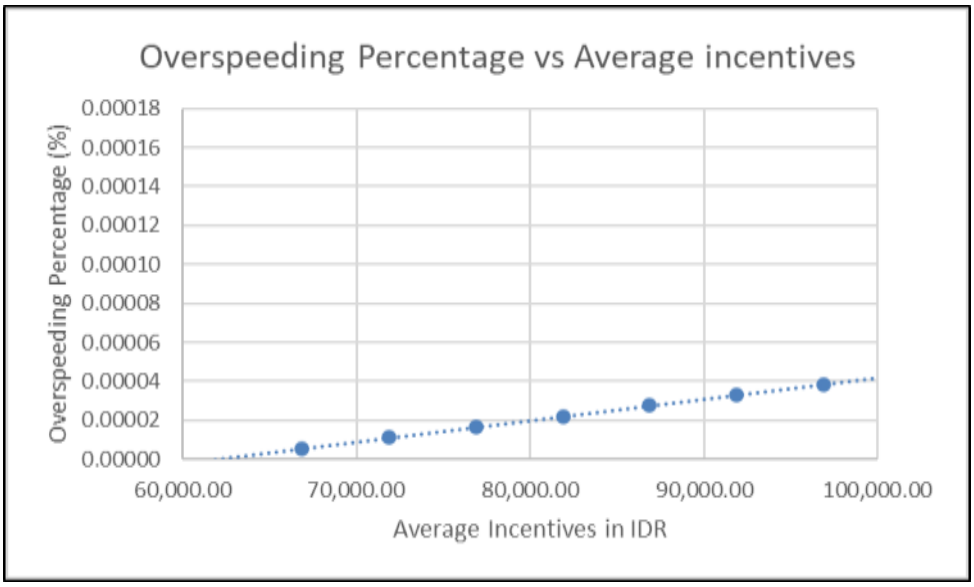

Figure 1. Overspeeding percentage vs driver incentive

Chi Square Test

To evaluate whether there is a statistically significant relationship between the type of incentive scheme and the overspeeding category, a Chi-square test was performed.

Table 1. Driver Incentive VS Overspeeding Category

NO	Incentive Scheme	No overspeed	Low Overspeed (1-10 km/hour) (Number of dump truck)	Medium Overspeed (11-20 km/hour) (Number of dump truck)	High Overspeed (21-30 km/hour) (Number of dump truck)
1	A	468	35	4	0
2	B	76	14	0	1

T Test

An independent samples t-test compared the average daily incentives of overspeeding vs. non-overspeeding drivers.

Table 2. t test

Group	Average Daily Incentive (IDR)
Overspeeding Drivers	89,825
Non-Overspeeding	89,519

The resulting t-statistic was 14.17, which exceeds the critical t-table value of 1.654 at df = 161. This confirms that overspeeding drivers received significantly higher incentives, strengthening the argument that incentive levels influence risk-taking behavior.

Feasibility of Incentive Scheme Modification

The study further tested the feasibility of converting all trip-based incentive schemes (Scheme B) into distance-based schemes (Scheme A). A simulation was performed by applying a base rate of IDR 1,000 per kilometer to each contractor's total average travel distance, then compared to the existing incentive payments under Scheme B.

Table 3. Daily Incentive Comparison: Scheme B vs. Scheme A (Simulation)

No	Contractor	Average Daily Incentive (Scheme B) in IDR	Simulated Incentive (Scheme A) in IDR
1	PT. BRA	86,734.23	44,219.62
2	PT. PB	72,963.55	32,608.15
3	PT. HK	51,312.52	17,104.17
4	PT. SGJ	89,145.05	46,482.34
5	PT. WKS	89,871.90	46,719.29

As shown in the table, converting Scheme B to a flat per-kilometer rate of IDR 1,000 resulted in a significant decrease in daily driver incentives, averaging 49–67% lower than the original rates. While this adjustment improves safety by removing trip-volume pressure, it also risks reducing driver motivation and contractor satisfaction (Ludfiandini & Nugroho, 2016).

To balance operational feasibility and financial fairness, the simulation included a second scenario by adjusting the per-kilometer incentive rate to IDR 2,500/km. This modification allowed for daily incentive values that:

1) Stay within contractual cost ceilings;
2) Maintain driver income levels close to the original Scheme B values;
3) Encourage safer driving behavior by decoupling earnings from trip frequency.

Furthermore, from a contractual standpoint, all participating contractors were found to have sufficient margin flexibility in their total logistics budget to accommodate the revised incentive formula without breaching the agreed contract values (Ayuningtyas, Kusumawati, & Ellizar, 2021).

CONCLUSION

This study demonstrates that driver incentive schemes in oil and gas logistics significantly influence overspeeding behavior, with trip frequency-based incentives (Scheme B) increasing the likelihood of unsafe driving compared to distance-based incentives (Scheme A). Quantitative analyses—including linear regression, chi-square testing, and t-tests—revealed that higher daily incentives correlate with more frequent overspeeding violations, while Scheme A promotes safer driving behavior, supported by a proposed threshold of approximately IDR 61,885 per day. Simulation results indicate that adjusting incentives to a distance-based rate of IDR 2,500/km can maintain cost feasibility for contractors while enhancing compliance with speed regulations. These findings suggest that incentive structures prioritizing output quantity over behavioral safety inadvertently elevate operational risks. Accordingly, companies are encouraged to redesign compensation schemes to balance productivity, fairness, and safety, incorporate continuous driver safety training, monitor compliance more actively through real-time feedback systems, and consider periodic reviews of incentive thresholds. Future research could explore additional behavioral and contextual factors, such as driver experience, fatigue, and road conditions, to further optimize incentive models and reduce overspeeding risks in high-mobility industrial operations.

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